Space Weather Technical Forecast

Issued on Saturday, 13 August 2022 at 00:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, although the cadence of small C-class flares detected at GOES16 has increased relative to earlier in the UTC week. The peak of these minor events was a C2.1 at 12/1020UTC, which emanated from the visually unassuming AR3077, which appeared as a simple Beta/Bxo. This was one of up to eight sunspot groups on the visible disc. Of these groups, three others showed some growth, with this most marked in AR3079 in the southern solar hemisphere near the meridian, which saw rapid proliferation to become a Dro/Beta-Gamma, although this growth slowed into the UTC evening.

Also of note were a new unnumbered region in the northeast, as well as newly-numbered AR3080, which both grew into bipolar regions - the latter from plage - before fading. The low level C-class flaring was well-spread between regions, although there was little change evident in the remainder of the magnetically unipolar and simple bipolar groups.

The southern solar hemisphere is currently showing a large number of small filaments, however none of these showed any movement in the period and no Earth-directed Coronal Mass Ejections (CMEs) were observed.

Solar Wind / Geomagnetic Activity: Earth appears to be transiting a sector of space under the influence from a waning fast wind environment, perhaps that related to CH12/+, the third of a train of three coronal holes that have dominated the past week in terms of geomagnetism.

The solar wind speed was Elevated over the past 24 hours, with L1 solar wind measures differing as in previous days according to which satellite is used, but both DSCOVR and ACE showed a slightly waning tendency in the upper 500s of km/s. The solar wind density showed a decline into single figures ppcc, perhaps more reliably shown at ACE, while the IMF also reduced in magnitude from an early high near 10nT to below 5nT later in the period. The north-south component was erratic at first between +9 and -5nT, but became smoother during the second half of the UTC day, as well as lower in magnitude. The phi angle was near-neutral at first, but gradually evolved into a more strongly positive regime with time (away from the Sun). This changed late in the period to become negative shortly before 12/2200UTC in a minor SSBC.

The net result of the above solar wind measures was provisionally mostly Quiet, with peak Kp of 3o in the 09-12UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels.

The high energy electron flux (greater than 2 MeV) was High throughout, with a peak of 3.34e3pfu at 12/0210UTC. The 24-hour integrated electron fluence was above Active

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throughout, with a slightly declining trend and with an observed value of 2.12e8 integrated pfu at 13/0000UTC.

Four-Day Space Weather Forecast Summary

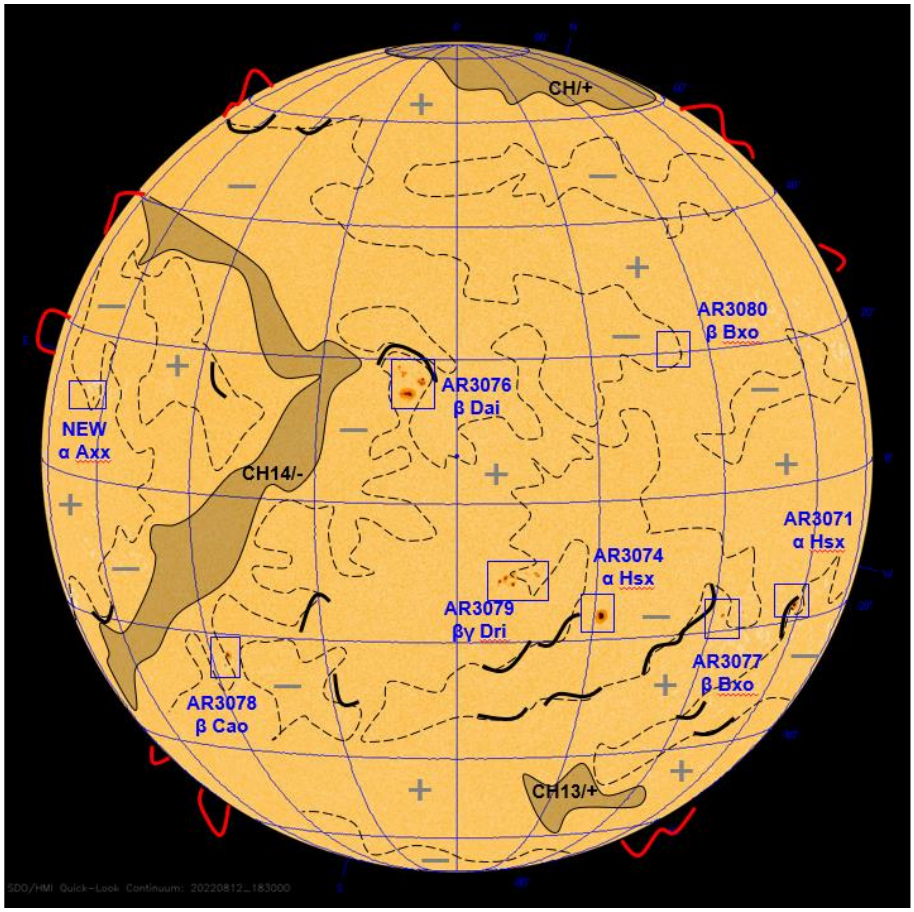
Solar Activity: Solar activity is expected to persist at Low levels, with a daily Slight Chance of rising to Moderate.

Solar Wind / Geomagnetic Activity: No Coronal Mass Ejections (CMEs) feature in the forecast, and the sole fast wind enhancement is already occurring, is mature and is likely to soon wane. There is a Slight Chance of isolated Active intervals at first, soon falling to Quiet, reliably so from the new UTC working week.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels.

High energy electron flux is expected to persist above the High (1e3 pfu) threshold through much of the period. Electron fluence is also expected to remain above the Active (1e8 integrated pfu) threshold throughout.

Figure 1. Solar Analysis Valid 12/1830UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs feature in the current forecast.

The sole fast wind enhancement expected in the four days is the current positive polarity coronal hole, perhaps that emanating from CH12/+, else being the tail end of CH10/+. Whatever the cause, this feature is considered to have long since peaked in terms of geomagnetism, with the IMF now near background levels.

There is a Slight Chance of an isolated Active interval at first should prolonged negative Bz arrive while the solar wind is still elevated, however this too should decrease through the first 24 hours to leave a largely Quiet remainder of the forecast - reliably so from the start of the UTC working week.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, although the size and cadence of C-class flares has increased in the past 24 hours, as well as number of sunspot regions and the 10.7cm Penticton flux. Growth in regions such as AR3079 is something to be monitored and is the main rationale for the daily Slight Chance of reaching M-class activity.

None of the current front side groups of note leave the disc in the period, while there are signs on STEREO A EUVI 195 imagery that there may be further returning regions waiting over the limb, to potentially arrive on the front side into the new working week UTC. Any rise in risk will be assessed as and when these regions present on the horizon, with a flat daily 15% risk of M maintained for now.

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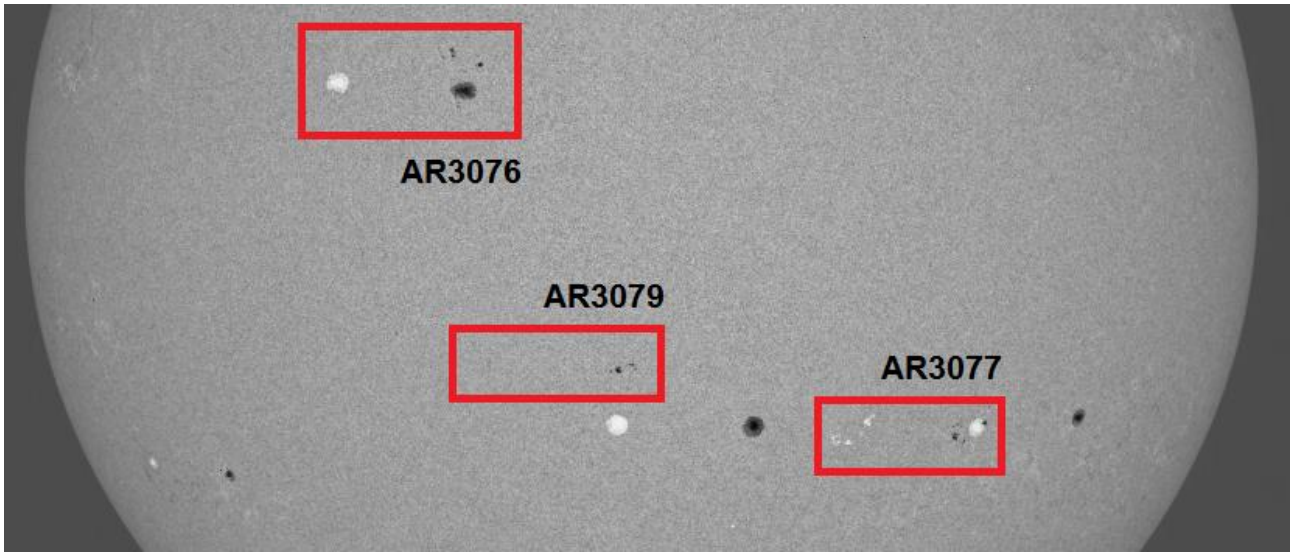
X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: Helioviewer.org-generated difference image of sunspot groups in the past 24 hours (11/2200UTC and 12/2200UTC). Note the main growth trends in the boxed regions (black = current).



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period.

Although the numbers of sunspot groups have increased in the recent past, these are mostly still simple dipoles or else unipolar. There is a slightly increasing risk of S1 or greater in the four days, but the increase is too slight to represent in the probability tables at present.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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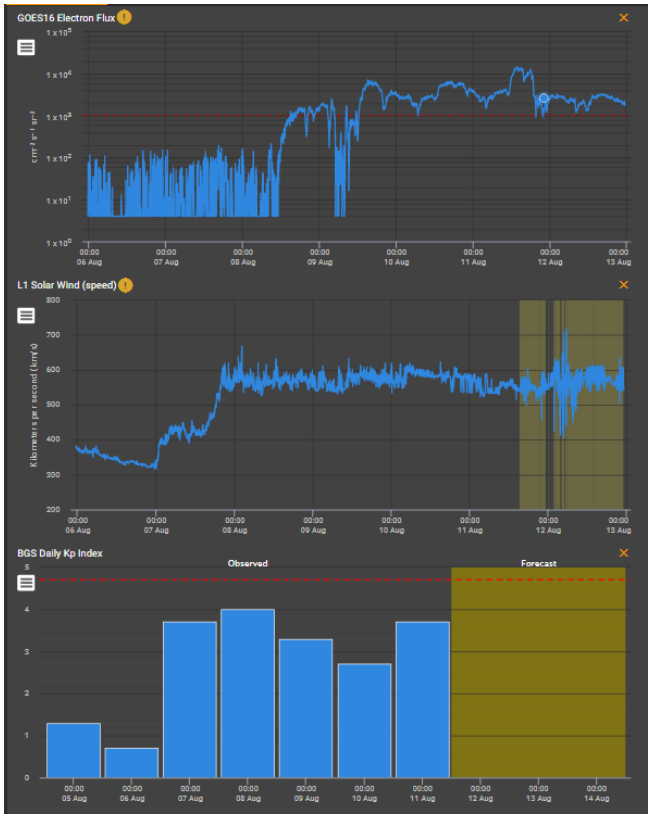
High Energy Electrons Event (≥ 2MeV):

High energy (greater than 2 MeV) electron flux as observed by GOES16 was High throughout the UTC day of Friday 12 August, and again showed a slightly unusual character in its diurnal maximum coming near the time of its usual minimum (at GOES16) at 0210UTC. This implies that the flux and fluence could have potential to rise further in the immediate term once the brakes of geomagnetic activity are released, with the caveat that the activity has not redistributed electrons.

All considered, even if there is a flux rise, the fluence is unlikely to have the legs to reach Very Active, with comfortably Active levels probably maintained throughout the four days now there are signs of geomagnetic activity and the driving coronal holes waning.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	99	90	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Top: past week in GOES16 heigh energy electrons, showing reaction to the fast wind from the succession of CH09, CH10 and perhaps CH12. Middle: The associated L1 solar wind speed as recorded by DSCOVR and ACE. Bottom: Daily Kp indices. The final two measures have been playing off against each other to give the current dented diurnal oscialltion within High flux.



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